

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE THE APPLICATION OF: HAYASHI, ET AL.

APPLICATION NO.: 10/561,830

FILLING DATE: DECEMBER 22, 2005

GROUP ART UNIT: 1795

EXAMINER: EOFF, ANCA

TITLE: POSITIVE RESIST COMPOSITION AND METHOD OF FORMING
RESIST PATTERN USING SAME

DECLARATION UNDER 37 C.F.R. § 1.132

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Sir:

I, Tomoyuki HIRANO, do hereby declare that:

I have been an employee of Tokyo Ohka Kogyo Co., Ltd., Japan, the assignee of the above-identified United States patent application, since April 2004, being engaged in research and development work relating to resist compositions and other related products of the company.

Although I am not one of the applicants of the above-identified application, I have full knowledge of the subject matter of the above-identified application.

I carried out experiments to evaluate the solubility of polymers (A)-1 to (A)-4 and (A)-3' produced in Hada declaration.

I have a good knowledge of the English language and have read and understood the application papers and the prosecution history of this and the antecedent applications as well as the Examiner's references cited therein.

PURPOSE, METHOD AND RESULTS

(1) Purpose of the Experiments:

The purpose of the Experiments described in this declaration is to evaluate the solubility of polymers (A)-1 to (A)-4 and (A)-3' described in the Rule 132 declaration of Hideo Hada submitted on December 2, 2009.

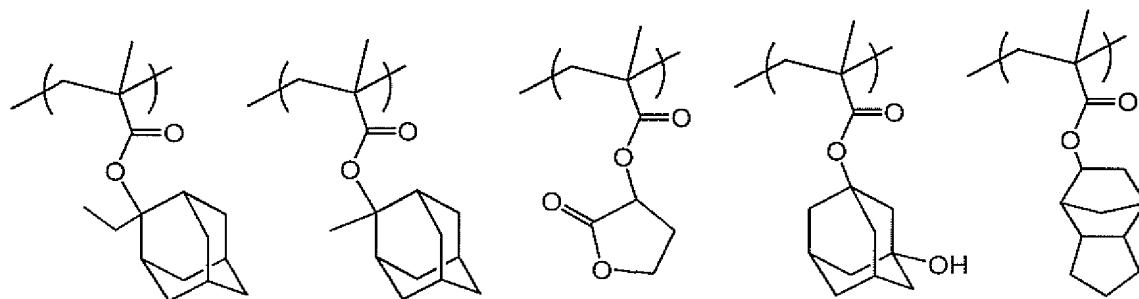
(2) Method and Results of Experiments:

Method:

(i) Production of polymers

Each of the polymers (A)-1 to (A)-4 and (A)-1' to (A)-3' having structural units with the molar ratio indicated in Table A was synthesized. The molar ratio of the respective structural units was determined by carbon 13 nuclear magnetic resonance spectroscopy (600MHz ^{13}C -NMR). Further, the weight average molecular weight (M_w) and the dispersity (M_w/M_n) of the obtained polymers were determined by the polystyrene equivalent value as measured by gel permeation chromatography (GPC).

Polymers (A)-1 to (A)-4 and (A)-1' to (A)-3' represent the same polymers that were used as in the Hada declaration, and were prepared in the same manner described in that declaration.



(a1)

(a2)

(a3)

(a4)

(a5)

[(a1) + (a2): 30-60]

[(a3):20-60]

[(a4): 5-50]

[(a5):1-30]

*Values in brackets indicate the molar percent range recited in claim 17 of the present application

Table A

Polymer	(a1)	(a2)	(a3)	(a4)	(a5)	Mw
(A)-1	20	10	20	45	5	9,500
(A)-2	25	20	35	5	15	8,200
(A)-3	25	10	20	40	5	9,000
(A)-4	25	20	25	5	25	8,700
(A)-3'	25	10	20	45	—	7,400

(ii) Evaluation of solubility

Each of the polymers (A)-1 to (A)-4 and (A)-3' were dissolved in an organic solvent (C) as shown in Table B below.

Table B

	Component (A)	Component (B)	Component (D)	Component (C)	
Test Example 1	(A)-1 [100]	---	---	(C)-1 [1000]	(C)-2 [100]
Test Example 2	(A)-2 [100]	---	---	(C)-1 [1000]	(C)-2 [100]
Test Example 3	(A)-3 [100]	---	---	(C)-1 [1000]	(C)-2 [100]
Test Example 4	(A)-4 [100]	---	---	(C)-1 [1000]	(C)-2 [100]
Comparative Test Example 1					
Comparative Test Example 2					
Comparative Test Example 3	(A)-3' [100]	---	---	(C)-1 [1000]	(C)-2 [100]

In Table B, the reference characters indicate the following. Further, the values in brackets [] indicate the amount (in terms of parts by weight) of the component added.

- (A)-1: aforementioned polymer (A)-1
- (A)-2: aforementioned polymer (A)-2
- (A)-3: aforementioned polymer (A)-3
- (A)-4: aforementioned polymer (A)-4
- (A)-3': aforementioned polymer (A)-3'
- (C)-1: propylene glycol monomethyl ether acetate (PGMEA)
- (C)-2: γ -butyrolactone

The obtained solutions were allowed to stand for 4 days at room temperature, and the state of the resin component (A) in the organic solvent (S) was evaluated. The results are shown in Table C.

Table C

	Polymer	(a1)	(a2)	(a3)	(a4)	(a5)	Mw	State of component (A) after being allowed to stand for 4 days at room temperature
Test Example 1	(A)-1	20	10	20	45	5	9,500	Dissolved
Test Example 2	(A)-2	25	20	35	5	15	8,200	Dissolved
Test Example 3	(A)-3	25	10	20	40	5	9,000	Dissolved
Test Example 4	(A)-4	25	20	25	5	25	8,700	Dissolved
Comparative Test Example 3	(A)-3'	25	10	20	45	—	7,400	Not dissolved

Results:

As seen from the results, polymers (A)-1 to (A)-4 containing all of the structural units (a1), (a2), (a3), (a4) and (a5), and the amount of the structural unit (a4) being in the range of 5 to 50 mol% could be dissolved in the organic solvent (C). In contrast, the polymer (A)-3' used in Comparative Example 3 of Hada declaration could not be dissolved in the same amount of the organic solvent (C) even after being allowed to stand for 4 days at room temperature.

(3) Conclusion

From the results of the experiments, it can be fairly concluded that a polymer which includes all of the structural units (a1), (a2), (a3), (a4) and (a5) in claimed amounts could be dissolved in an organic solvent (C). In contrast, polymer (A)-3' used in Comparative Test Example 3 of Hada declaration could not be dissolved in the organic solvent (C), meaning that it requires excess filtration to produce a resist composition, and is therefore disadvantageous in practical use.

I further declare that all statements made herein to our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Tomoyuki HIRANO
Signature (Tomoyuki HIRANO)

Sept. 9, 2010
Date